Lyme Disease *(Borrelia burgdorferi)*

(Also known as Lyme borreliosis and Tickborne meningopolyneuritis)

October 2003

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Lyme disease (LD) is caused by the corkscrew-shaped bacterium (spirochete) *Borrelia burgdorferi*.

B. Clinical Description and Laboratory Diagnosis

While the chronology of signs and symptoms can vary significantly, there are three general stages in the clinical manifestation of LD: early localized, early disseminated, and late.

Early Localized

Signs and symptoms during the early illness tend to be nonspecific and include fever, muscle aches, headache, mild neck stiffness, and joint pain. Erythema migrans (EM) occurs at the site of the tick bite in approximately 60%-90% of cases, although when these painless lesions occur in a location hidden from view (armpit, back, etc.), they are often not seen by the patient. Typically, EM rashes are circular and grow to a diameter of 5 to 15 cm, although the shape can be triangular, oval, or irregular. EM frequently clears in the center, resulting in the classic "bull's-eye" presentation, but this does not always occur. The rash may be reported as warm or itchy, but it is usually painless. **For purposes of surveillance**, EM is a skin lesion that typically begins as a red macule or papule and expands over a period of days to weeks to form a large round lesion, often with partial central clearing. A solitary lesion must reach at least 5 cm in size. Secondary lesions may also occur. EM does not always present as a classic "bull's eye." It may present as an irregular erythematous patch (with or without central clearing), as an oval or triangular erythematous lesion, as an elongated erythematous lesion, or as multiple erythematous lesions. Annular erythematous lesions occurring within several hours of a tick bite represent hypersensitivity reactions and do not qualify as EM. In most patients, the expanding EM lesion is accompanied by other acute symptoms, particularly fatigue, fever, headache, mild stiff neck, arthralgias, or myalgias. These symptoms are typically intermittent. A physician must make the diagnosis of EM. Laboratory confirmation is recommended for persons with no known exposure.

Early Disseminated

In untreated persons, multiple EM rashes may appear within 3 to 5 weeks after the tick bite. These secondary lesions, indicative that the infection has spread into the blood, resemble the primary lesion but tend to be smaller. Common signs of early disseminated disease also include brief arthritis attacks, paralysis of facial muscles (Bell's palsy), and regional or generalized lymphadenopathy. At this stage, disruptions of heart rhythm occur in less than 10% of cases.

Late

Most commonly, late disease is marked by recurrent arthritis (swelling and pain) in the knees and shoulders. Other joints may also be involved. Neurological signs may involve impairment of mood, sleep, or memory; paralysis of facial muscles; pain or tingling sensations in the extremities; and less commonly, meningitis and encephalitis. Late-stage symptoms can persist for several years, but tend to resolve spontaneously.

Diagnosis is currently based on clinical findings supported by serologic tests performed in two stages: IFA or ELISA and those with equivocal or positive results should be tested with Western immunoblot. Serodiagnosis

early in infection is insensitive because the specific immune response in LD develops slowly. Isolation of *B. burgdorferi* from blood or tissue biopsies is difficult; however, biopsies from the EM are positive in 80% of cases. The usefulness of PCR in the diagnosis of LD has yet to be verified. Generally, prophylactic antibiotic therapy is not indicated after a tick bite, as the risk of infection with *B. burgdorferi* after a tick bite is relatively low, even in endemic areas. However, recent randomized trials have shown that antimicrobial prophylaxis with a single dose of antibiotic, given after a confirmed bite by an *Ixodes scapularis* tick within the 72 hours, may be effective in preventing LD in highly endemic areas.

C. Vectors and Reservoirs:

The primary vectors for LD are *Ixodes* ticks, a distinct genus from the larger and better-known American dog tick (*Dermacentor variabilis*). In the Northeast and upper Midwest, the prominent vector is the blacklegged or deer tick, *Ixodes scapularis*. Ticks acquire the spirochete that causes LD in the larval or nymphal stage by feeding on infected animals, especially the white-footed mouse. The tick poses the greatest threat of transmitting infectious organisms to animals and humans when it bites during the nymphal stage. Nymphs are most abundant between May and July, and they are typically found in wooded areas, brush, and grassy areas near woodland edge. Towards the end of summer through fall, the nymphs mature to the adult stage. Although adult ticks remain capable of transmitting *B. burgdorferi* to humans, they are less likely to do so.

D. Modes of Transmission:

LD is acquired from a tick bite. Laboratory data suggest that the tick must usually remain attached for 24 to 48 hours before the transmission of *B. burgdorferi* can occur. Since bites from *I. scapularis* are often painless and may occur on parts of the body that are difficult to observe, cases of diagnosed LD frequently have no known history of a tick bite.

E. Incubation Period

EM typically develops between 7 and 10 days after exposure (range: 3 to 32 days). However, an infected individual can remain asymptomatic until the later stages of LD, several months to one year later.

F. Period of Communicability or Infectious Period

Lyme disease is not communicable from person-to-person.

G. Epidemiology

The incidence of LD is associated with the density of infected tick vectors. Most cases in the United States have been reported in the northeastern, mid-Atlantic and north-central regions. LD incidence varies greatly among states and counties, and by season. Most cases occur between April and October, when the risk of contact with nymphal ticks is greatest. In New Jersey, the highest risk for acquiring LD occurs in wooded rural or suburban environments. However, all parts of the state are considered to have LD, and human cases have been reported from all counties in New Jersey in individuals without a travel history to high-risk areas.

2) REPORTING CRITERIA AND LABORATORY TESTING SERVICES

A. New Jersey Department of Health and Senior Services (NJDHSS) Case Definition:

CASE CLASSIFICATION

A. CONFIRMED

1. Patient with EM confirmed by physician
2. At least one clinically compatible late manifestation without an alternative explanation **AND:**
    - Isolation of *Borrelia burgdorferi* from clinical specimen, **OR**

- Demonstration of diagnostic IgM or IgG antibodies to *Borrelia burgdorferi* in serum or cerebrospinal fluid (CSF). A two-test approach using a sensitive enzyme immunoassay or immunofluorescence antibody (IFA) technique followed by Western blot is recommended, **OR**
- Detection of a significant change in antibody levels in paired acute- and convalescent-phase serum samples.

NOTE: Vaccine induced anti-rOspA antibodies routinely cause false positive ELISA results for LD. However, experienced laboratory workers, through careful interpretation of the results of Western blot assay, can usually discriminate between *Borrelia burgdorferi* infection and previous rOspA immunization, because anti-rOspA antibodies do not develop after natural infection.

B. PROBABLE
Not used.

C. POSSIBLE
Not used.

Note: See Section 3 C below for information on how to report a case.

B. Laboratory Testing Services Available

The NJDHSS Public Health and Environmental Laboratories (PHEL) provide tick identification and culturing for the detection of *B. burgdorferi.* In addition, PHEL performs testing on paired sera to determine the presence of *B. burgdorferi* antibodies using IFA. For additional information on submission of samples, contact the Special Immunology Laboratory at 609.292.5819.

3) DISEASE REPORTING AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify where LD occurs in New Jersey.
- To recognize areas in New Jersey where LD incidence has changed (increased or decreased).
- To focus preventive education.
- To target tick control measures.

B. Laboratory and Healthcare Provider Reporting Requirements

The New Jersey Administrative Code (N.J.A.C. 8:57-1.8) stipulates that laboratories report (by telephone, confidential fax, over the Internet using the Communicable Disease Reporting System [CDRS] or in writing) all cases of LD to the local health officer having jurisdiction over the locality in which the patient lives, or, if unknown, to the health officer in whose jurisdiction the health care provider requesting the laboratory examination is located. The health care providers must report all cases of LD to the local health officer having jurisdiction over the locality in which the patient lives.

C. Local Department of Health Reporting and Follow-up Responsibilities

1. **Reporting Requirements**
   The New Jersey Administrative Code (N.J.A.C. 8:57-1.8) stipulates that each local health officer must report the occurrence of any case of LD, as defined by the reporting criteria in Section 2 A above. Current requirements are that cases be reported to the NJDHSS Infectious and Zoonotic Diseases Program (IZDP).
2. **Case Investigation**

a. It is the local health officer's responsibility to ensure the NJDHSS Lyme Disease Case Investigation Form is completed by interviewing the case and others who may be able to provide pertinent information. Much of the information required on the form can be obtained from the case's healthcare provider or the medical record.

b. Use the following guidelines to complete the form:
   1. Accurately record the demographic information, date of symptom onset, and date of diagnosis.
   2. Record information about clinical presentation by checking all of the signs and symptoms that applies.
   3. **If the case meets the case definition,** the form along with all laboratory results should be mailed/faxed to the NJDHSS IZDP.
      a. CDRS users: Patient Personal Information, Patient Healthcare Information, and Laboratory Test fields should be completed. The Lyme Disease Case Investigation Form (CDS-14) should still be completed and sent to IZDP for clinical symptom assessment. Local health departments are asked to ensure that the most accurate information available is recorded in CDRS and **not to confirm cases on CDRS** themselves. **Case confirmation will be done at the NJDHSS level**, in order to ensure consistency in reporting criteria. Cases should be entered into CDRS as "Not a case".

   The mailing address and fax are:

   NJDHSS
   Division of Epidemiology, Environmental and Occupational Health
   Infectious and Zoonotic Diseases Program
   P.O.Box 369
   Trenton, NJ 08625-0369
   Fax 609.588.2546

NOTE: Laboratories and physicians sometimes report LD directly to the NJDHSS instead of the local department of health. In patients in whom further information is needed to ascertain whether or not they are a confirmed case, the reports will be mailed to the local department of health for follow-up as indicated above.

If the local department of health has already submitted a LD Case Investigation Form on this patient, or has determined that cases do not meet the case definition, no action is necessary.

c. Institution of disease control measures is an integral part of case investigation. It is the local health officer's responsibility to understand, and, if necessary, institute the control guidelines listed below in Section 4C, "Controlling Further Spread."

4) CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (N.J.A.C. 8:57-1.10)

None.

B. Protection of Contacts of a Case

None.

C. Managing Special Situations

Response to a Tick Bite

Generally, prophylactic antibiotic therapy is not indicated because the risk of infection with *B. burgdorferi* after a tick bite is relatively low, even in endemic areas. Prophylactic therapy may be appropriate for some individuals (*e.g.,* pregnant women) while more data are collected.

D. Preventive Measures

Offer the following advice to the public to reduce risk for LD.

Environmental Measures

Prevention of LD involves keeping wildlife (especially deer and rodents) out of backyard and making yard less attractive to ticks through:

- Removing leaf litter and brush from around the home.
- Pruning low-lying bushes to let in more sunlight.
- Mowing lawns regularly.
- Making sure any plants near home are not varieties that attract deer.
- Keeping woodpiles in sunny areas and off the ground.
- Cleaning up the ground around bird feeders.
- When using acaricides around home, always follow the label instructions and never use near streams or other bodies of water.

Personal Preventive Measures/Education

The best preventive measure is to avoid tick-infested areas. In areas where contact with ticks may occur, individuals should be advised of the following:

- Wear long-sleeved shirts and long, light-colored pants tucked into socks or boots.
- Stay on trails when walking or hiking and avoid high grass.
- Use insect repellents properly. Repellents that contain DEET (diethyltoluamide) should be used in concentrations no higher than 10% for children and 30% for adults. Remember, repellents should *never* be used on infants. Permethrin is a repellent that can only be applied to clothing, *not* exposed skin.
- After each day spent in tick-infested areas, check yourself, your children, and your pets for ticks. Parts of the body ticks like most include the back of the knee, armpit, scalp, groin, and back of the neck.
- Promptly remove any attached tick using fine-point tweezers. The tick should not be squeezed or twisted, but grasped close to the skin and pulled straight out with steady pressure. Once removed, the tick can be saved for identification (see Appendix: Ticks examination) or should be drowned in rubbing alcohol or in water.

Note: Since December 1998, a vaccine was available for LD (LYMErix, Glaxo SmithKline). In clinical trials, the vaccine was demonstrated to be about 70 to 80% effective in protecting individuals aged 15–70 years who received three doses of the vaccine according to the approved administration schedule. Since the vaccine is not 100% effective and does not protect against other tick-borne diseases, previously immunized individuals should continue to practice the preventive measures described above. Accelerated 3 and 6-month vaccination schedules and the efficacy of this vaccine in children under 15 are also being evaluated. The vaccine was taken off the market in 2002 by the manufacturer due to lower than expected demand.

ADDITIONAL INFORMATION

Several Lyme disease fact sheets including *Tick-borne Diseases of New Jersey* can be obtained from the NJDHSS website at <http://www.state.nj.us/health>.

The formal Centers for Disease Control and Prevention (CDC) surveillance case definition for Lyme disease is the same as the criteria outlined in Section 2 A of this chapter. CDC case definitions are used by state health departments and CDC to maintain uniform standards for national reporting. When reporting a case to the NJDHSS, always refer to the criteria in Section 2 A.

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